

News

Creating Comets

Late next month, if all goes as planned, the "world's first artificial comet" will be created when a satellite stationed 110,000 km deep in space, just outside the earth's magnetosphere, releases a cloud of barium ions. The phenomenon—a bluish-white, 800-km long "cloud" that should be visible to the naked eye for about 10 minutes—will provide scientists with some clues about how the solar wind affects comet tails. The experiment is one of several in a three-station, three-satellite study of the solar wind, comets, and the magnetosphere.

The "artificial comet" experiment will be the second of three sets of scheduled ion releases as part of the Active Magnetospheric Particle Tracer Explorers (AMPT) project, a study involving scientists from the Federal Republic of Germany, the United Kingdom, and the United States. Two lithium releases have taken place to date. The scientists hope to trace the solar wind's path by using these ion discharges.

Lithium and barium were chosen for two reasons: The solar wind contains very small concentrations of these substances, and both are easily ionized. Ions, or charged particles, are sensitive to the electromagnetic forces found in space. Ionized barium and lithium atoms released outside the magnetosphere should serve as a "dye" and allow scientists to trace the solar wind's path as it encounters and enters the magnetosphere.

The lithium vapor clouds, which ionize more slowly than barium, will not be visible to the naked eye. However, scientists expect the lithium cloud to expand over an area of 8,000–16,000 km, which will allow them to "map" a large area of the magnetosphere.

Scientists at the Applied Physics Laboratory (APL) of Johns Hopkins University are currently analyzing data gathered from the first two lithium releases. Initial results indicate that lithium was detected inside the magnetosphere by a satellite stationed there but has not yet been conclusively traced to the satellite discharge outside the magnetosphere.

The three satellites used in AMPT were launched in a stack aboard a Delta rocket from Cape Canaveral on August 16, 1984. The Federal Republic of Germany's 705-kg Ion Release Module (IRM), from which the lithium was discharged, is stationed outside the magnetosphere. The lithium and barium are held in 16 ejectable aluminum canisters strapped to the outside of the satellite. Instruments to monitor local conditions around the IRM are also being carried, which will help the scientists select the optimum time for the ion releases.

The U.S. satellite, the 242-kg Charge Composition Explorer (CCE), designed and built by APL, is looking for the presence of the lithium "tracer" ions after they enter the magnetosphere. The United Kingdom Sub-satellite (UKS), a maneuverable 77-kg spacecraft, is situated within a few hundred kilometers from the IRM and is designed to measure magnetic fields, plasma waves, electrons, and ions. Several U.S. ground observatories will also monitor the experiments, as will aircraft flying over North and South Pacific areas.

NASA says the AMPT project may very well have some short-term practical applications in addition to purely scientific discoveries. Data obtained may shed some light on how to protect the delicate electronic circuits carried aboard satellites and manned spacecraft from the solar wind, a stream of ionized gas traveling at a speed of about 1.6×10^6 km/h. Spacecraft electronic component failures attributed to the solar wind have been fairly common in the past; exactly how the instruments are damaged is not clear. Results from the AMPT mission may provide some clues to help engineers "harden" spacecraft components against such failures.

According to NASA, the "comet" created by the December barium release should be visible in the western United States, Hawaii, and parts of the eastern Pacific Ocean. After two more lithium releases, scheduled for March 1985, the "active" phase of the AMPT project will be concluded. The satellites will remain in space, monitoring the solar wind and the earth's magnetosphere.

—DWR

New Solar System

Using sensitive optical instruments and computer enhancement techniques, two astronomers believe that they may have "photographed" what could be a new solar system forming around Beta Pictoris, a star 50 light-years from earth. Using a 254-cm telescope at the Las Campanas Observatory in Chile, combined with a charged-coupled device (CCD) and a coronagraph, an optical instrument developed for detecting very faint objects close to brighter ones, the astronomers photographed clearly for the first time a large group of solid particles, called a circumstellar disk, surrounding the star. This disk may be evidence of a new solar system.

The scientists, Bradford A. Smith of the University of Arizona, Tucson, and Richard J. Terrell of the Jet Propulsion Laboratory (JPL), Pasadena, Calif., say that there is some evidence that planets could have formed around the star. The brightness of the star seen through its disk indicates that the innermost particles of the disk may have been swept away; the formation of planets would produce this effect. However, the astronomers have not yet been able to determine if there are actually planets around the star.

The circumstellar disk, believed to be no more than a few hundred million years old because it is relatively flat, appears nearly edge-on as viewed from the earth and extends more than 64×10^6 km, or more than 400 times the distance from the earth to the sun.

The disk is believed to be made up of particles ranging in size from tiny grains less than ten microns in diameter to the size of the nuclei of comets a few kilometers across. Scientists believe the composition includes ice, silicates and carbonaceous compounds, the same materials from which the earth and other planets of the solar system are believed to have formed.

GRL Editors: 1986–1988

The leading rapid publication journal in the geophysical sciences is seeking candidates to succeed James C. G. Walker, whose term as editor-in-chief ends December 1985. AGU also seeks candidates to succeed the five regional editors: Rob Van der Voo, North America; Gaston J. Kockarts and William Lowrie, Europe; Tetsuya Sato, Asia; and Kurt Lambeck, Australia. AGU President Charles L. Drake has appointed a committee to recommend candidates for the 1986–1988 term. Resumes of those interested in serving in these influential and prestigious posts or letters of recommendation from those who wish to suggest candidates should be sent by February 15, 1986, to GRL Editor Search Committee, American Geophysical Union, 2000 Florida Ave., N.W., Washington, DC 20009.

PASSCAL Science Planning

The Program for Array Seismic Studies of the Continental Lithosphere (PASSCAL) is one of two major scientific initiatives organized this year under Incorporated Research Institutions for Seismology (IRIS). PASSCAL is a cooperative program open to the whole earth science community. Participation is through PASSCAL committees, which are open to all interested scientists.

The Science Planning and Coordination Committee of PASSCAL will hold an experiment planning meeting at the AGU Fall Meeting in San Francisco. The meeting will be held Tuesday, December 4, 8–5 P.M. in Room 327 of the Convention Center. All interested earth scientists are encouraged to participate in this meeting and to help develop plans for cooperative experiments for studying the continental lithosphere. Experiments that can be realized with existing instrumentation, as well as with the PASSCAL instruments currently under development, are encouraged. Topics to be discussed at the meeting include review of science planning and coordination activities of PASSCAL, review of ongoing lithospheric seismology experiments, discussion of proposed experiments, and general discussion of science planning activities.

During the past years, several new cooperative programs to study specific geologic problems have been launched. These activities include both multiyear multidisciplinary studies and single-purpose experiments. Status reports will be presented at the planning meeting on several of these efforts, including the Trans-Alaskan Lithospheric Investigation (TALI), the Appalachian Drill Site Characterization study, the Southern Oklahoma Aulacogen wide-angle experiment, and the Long Valley, California, Magma Chamber Study. Presentations from other groups currently conducting lithospheric seismology experiments or individuals interested in proposing new cooperative experiments are also strongly encouraged.

These experiments will be important not only for their scientific results but will also serve as prototype experiments for PASSCAL and will provide experience in design and operation of array seismic experiments and developments in data management, processing, and interpretation capabilities. Although a number of lithospheric seismology projects are presently in progress, as described above, it is anticipated that new large-scale array seismic experiments can be successfully completed in the next 2–3 years and will serve as benchmarks for the PASSCAL effort. Instruments presently available for lithospheric studies include the 120 component seismic refraction system of the U.S. Geological Survey, portable digital seismographs available from industry on a lease basis, large-spread reflection profiling equipment, and a limited number of digital seismographs from universities and national laboratories.

Investigators are also encouraged to develop smaller-scale research efforts related to improvements in seismic array studies technology necessary for future implementation in PASSCAL experiments. Such efforts could include studies of effective use of array recording, efficiency of controlled sources, capability for seismograph triggering for natural sources, improved data management procedures, techniques to improve signal-to-noise ratio in array recording, and development of new data processing and interpretation procedures for lithospheric array studies.

We request that persons wishing to present discussions of proposed new seismic experiments please contact Bill Ellsworth (U.S. Geological Survey, MS 77, 345 Middlefield Rd., Menlo Park, CA 94025) or Larry Bralle (Department of Geosciences, Purdue University, West Lafayette, IN 47906), and prepare a 5-minute presentation of their plans.

This news item was contributed by Bill Ellsworth and Larry Bralle, Co-Chairmen of the Science Planning and Coordination Committee of PASSCAL.

Friends of Science

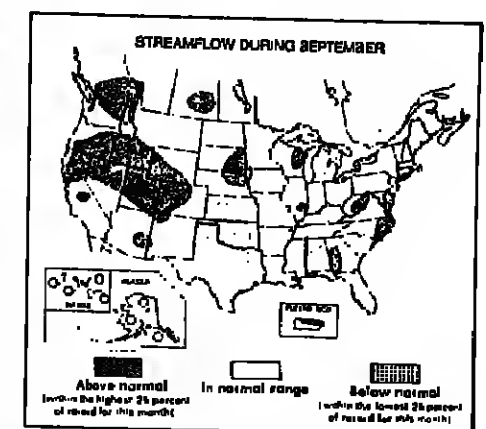
Ten members of Congress have been presented with the Friends of Science Award by the National Coalition for Science and Technology (NCST). The awards, honoring significant contributions to science, engineering, and science education, are made every 2 years at the end of the congressional session. The recipients this year are Sen. Pete V. Domenici (R-N.M.), Rep. Joseph D. Early (D-Mass.), Rep. Bill Frenzel (R-Minn.), Rep. Albert Gore, Jr. (D-Tenn.), Rep. Judd Gregg (R-N.H.), Sen. Daniel K. Inouye (D-Hawaii), Rep. Stan Lundine (D-N.Y.), Sen. Sam Nunn (D-Ga.), Rep. Henry Waxman (D-Calif.), and Rep. Ed Zschau (R-Calif.).

Except for Sen. Inouye, whose term expires in 1988, all of this year's recipients were up for reelection in the national elections held November 6. All were successful in securing another term in Congress. In addition, Albert Gore was successful in his bid for a Senate seat, filling the vacancy left by the retiring Senate Majority Leader Howard H. Baker (R-Tenn.).

September Streamflow

Streamflow decreased seasonally in September but remained in the normal or above-normal range in about 80% of the country, according to the regular end-of-month check of the nation's surface and groundwater resources by the U.S. Geological Survey (USGS), Department of the Interior. From 174 key index stream-gaging stations, USGS hydrologists reported average flows at 110 sites (63%), well-above average flows (i.e., in the upper 25% of long-term record) at 34 locations (30%), and well-below average flows (in the lowest 25% of record) at 30 stations (17%).

By geographic location, streamflows were well above average in most western states, including all key stations in Utah (6) and Colorado (4), and in parts of the central and



southeastern United States. Streamflows were well below average at all key stations in Hawaii (4), Connecticut (4), Maine (3), and New Hampshire (1) and in parts of Florida, Kansas, Minnesota, Montana, Oklahoma, Texas, and the east-central United States.

Record high or near-record high average flows (among the three highest of record) occurred in Colorado, Idaho (2 sites), Nevada, Utah (3 sites), Wyoming, and Puerto Rico. Record high streamflow for September occurred at two gaging stations which have been in the well-above average range now for 27 straight months: the Humboldt River at Fallsale, Nev. (77-year period of record), and the Snake River at Weiser, Idaho (74-year period of record). Record low or near-record low flows occurred in Florida, Hawaii (2 sites), Kentucky (2 sites), Louisiana, and Minnesota.

Reports on the three major U.S. rivers—the Mississippi, St. Lawrence, and Columbia—reflected general conditions. Their combined average flow was 435 billion gallons per day (bgd) or 5% above average for September. The three major rivers drain more than half of the lower 48 states and provide hydrologists with a convenient check on the overall status of the nation's water resources.

Hydrologist Hal Tang of the USGS National Center in Reston, Va., said that contents of key index reservoirs declined seasonally in September and were average to above average in most of the country. The contents of some reservoirs, however, were much below average: in Montana, New Hampshire, New Mexico, North Carolina, Oklahoma, Texas, and Washington. Tang noted that while most groundwater levels declined during September, most were also above average for the month. In the western states, groundwater levels rose in Washington and fell in North Dakota and Nebraska. Water levels were above average in Washington and in most of Idaho and were below average in Arizona, Texas, and most of New Mexico. Record low levels for September occurred at key USGS observation wells in Arizona, New Mexico, and Texas. Record high levels were reached in Idaho, Nevada, and Utah. All-time high levels were measured at key wells in California (27 years of record) and Utah (13 years of record).

Individual flows of the nation's five largest rivers for September were as follows. While the average flow of each of the "Big Five" rivers declined seasonally from August, flows of four of the large streams were above average for the month. The Mississippi River at Vicksburg, Miss., with an average flow of 176 bgd, was 3% below long-term average; the St. Lawrence River near Massena, N.Y., at 193 bgd, was 15% above average; the Ohio River at Louisville, Ky., 19 bgd, was 27% greater than the long-term average; the Missouri River near Hermann, Mo., at 43 bgd, was 24% above average; and the Columbia River at The Dalles, Ore., at 65 bgd, was 5% greater than the long-term average.

JGR-Space Physics Editors: 1986–1989

AGU is seeking candidates to succeed Bengt U. Ö. Sonnerup as JGR-Space Physics editor. His term as editor ends December 1985.

The successful candidate will handle original contributions on aeronomy, magnetospheric physics, planetary atmospheres and magnetospheres, interplanetary and external solar physics, cosmic rays, and heliospheric physics.

AGU President Charles L. Drake has appointed a committee to recommend candidates for the 1986–1989 term. Resumes of those interested in serving in this critical AGU position or letters of recommendation from those who wish to suggest candidates for it should be sent by February 15, 1986, to JGR-Space Physics Editor Search Committee, American Geophysical Union, 2000 Florida Ave., N.W., Washington, DC 20009.

EOS

Eos, Transactions, American Geophysical Union

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WaterWatch
News of the Hydrology Section

Editor: Mary P. Anderson, Department of Geology and Geophysics, University of Wisconsin-Madison, Madison, WI 53706 (608-262-2396).

Information Report

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The following is a list of officers and committees members.

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Ed McBean, Department of Civil Engineering, University of Waterloo, Waterloo, Ontario, Canada N2L 3C1 (telephone: 519-885-1211).

AGU Hydrology Awards: Horton, Horton, and Horton

There are three individual awards available to hydrologic researchers through the AGU. All three bear the name of Robert E. Horton, and because of this there appears to be considerable confusion among the membership as to the purpose of the awards, eligibility for them, and the method of their adjudication.

The *Horton Medal* is a Union award. It is given in alternate years to a senior scientist for outstanding research contributions in hydrology made over a period of many years.

The selection committee is a subcommittee of the AGU Committee of Fellows. The chairman and the members of the subcommittee are appointed by the President of AGU. The executive committee of the Hydrology Section is usually asked for recommendations for the membership of the Horton Medal subcommittee; in recent years the chairman and all members have come from this section.

1985 is an off year for the Horton Medal, and it will next be awarded at the AGU Spring Meeting in 1986. Nominations are solicited through notices in *Eos* that appear well before the deadline date.

The *Horton Award* is a Hydrology Section award. It is given each year to a researcher who has published papers of outstanding excellence in hydrology. It usually goes to a young or middle-aged scientist at the peak of his or her career. The selection committee is appointed by the President of the Hydrology Section. The award is presented at the AGU Fall Meeting each year. Nominations can be sent to the President of the Hydrology Section at any time.

The *Horton Research Grant* is also a Hydrology Section award. It is given each year to a Ph.D. candidate in support of a research project in hydrology or water resources. Its objective is to foster graduate student research leading to the completion of doctoral dissertations. It is the only hydrology award that carries a stipend; in 1984 the stipend was \$5500. The selection committee is appointed by the President of the Hydrology Section. The award is presented at the AGU Spring Meeting each year. Applications are solicited through notices in *Eos* that appear well before the deadline date.

In view of the confusion over three awards having the same name, it would be easy to make a case for changing the name of one or more of them. However, there are good reasons why the Horton name was used in each case. The stipend for the Horton Research Grant and the costs of striking the Horton Medal come from the Horton Fund for Hydrologic Research, a bequest to AGU from the late Robert E. Horton. The Horton Award would perhaps be the easiest to change, yet it is the award with the longest tradition. I would be interested in hearing the views of the membership on this issue.

This information report was written by R. Allan Freeze, President, AGU Hydrology Section.

News & Announcements

Contaminant Hydrogeology in the German-Speaking Part of Europe

Introduction

In the (mainly) German-speaking countries of Europe (the Federal Republic of Germany, the German Democratic Republic, Austria, and Switzerland), 70-85% of the drinking water supplies are drawn from groundwater.

Aquifers along many rivers, consisting of glacial or fluvial granular deposits, are important resources which are recharged by both influent rivers and seepage of water.

precipitation. Groundwater is threatened by the continuing and increasing presence of

toxic and mobile contaminants from waste-disposal sites, agricultural pesticides and fertilizers, and sewage effluents. Much of the hydrogeological research in these countries is therefore devoted to what has become known in English as contaminant hydrogeology.

Unlike the hydrogeologists of the New World, European hydrogeologists do not meet regularly in a group, and relatively few results from German-speaking researchers are published in English. Consequently, it is more difficult to know what researchers are doing in Europe than it is in North America.

Much of the work of German-speaking hydrogeologists was published in "Quality of Groundwater" (the proceedings of the Norddeutscher conference, heretofore referenced as *Stud. Environ. Sci.*, 17, 1981).

Transport Studies

When considering the problem of defining the nature of transport processes in field studies, German hydrogeologists rely to a considerable extent on field experiments. Although its limitations are recognized, e.g., by Frieel (*Stud. Environ. Sci.*, 17, 807-822, 1981), tracer experiments are often interpreted by using an advection-dispersion model.

Behrens and Seiler (*Stud. Environ. Sci.*, 17, 649-657, 1981) noticed an approximately linear increase of longitudinal dispersivity with increasing displacement distance in Bavarian aquifers. Klotz et al. (*J. Hydrol.*, 43, 169-184, 1980) concluded from column and model tank experiments that the relation between linear flow velocity and hydrodynamic dispersion deviates slightly from linearity. They assessed the horizontal transverse dispersivity to be much smaller than the longitudinal.

Kinzelbach (*Water Sci. Technol.*, in press) determined the hydraulic efficiency of purge well systems for decontaminating aquifers by using a numerical random walk transport model. Biogeochemical vertical fluxes and temperature stratifications near injection wells may result from cooling waters injected into granular aquifers (Mellhorn and Kobus, *Groundwater* in water resources planning, *Proc. Int. Symp. Koblentz 1984*, 303-304, 1983).

To date, the presence of *Escherichia coli* bacteria has been used to indicate fecal contamination of groundwater: Alexander and Seiler (*Int. Assoc. Hydrogeol. Ann.*, 17, 73-85, 1982) injected simultaneously high quantities of $E. coli$ and ^{22}Na as a pulse stimulus at the Donau field site in Bavaria; both maximum response concentrations were found to occur in observation wells at about the same time.

Mathess and Pekdeger (*Stud. Environ. Sci.*, 17, 427-437, 1981) added salt tracers to the advection-dispersion equation to account for biological elimination of pathogenic bacteria. Isotope methods used in transport studies have been reviewed in a textbook by Moser and Rauter (*Hydrogeologie in der Hydrologie*, Gebrüder Borntraeger, Stuttgart, Federal Republic of Germany, 1981).

Chemical Studies

Results of laboratory experiments have been verified in field studies of groundwater contamination using chemicals. Much of the work is related to the study of the retention of trace contaminants in aquifers and is based on the Stumm and Morgan textbook *Aquatic Chemistry* (2nd ed., Wiley Interscience, New York, 1981). Mathless (*Stud. Environ. Sci.*, 17, 291-296, 1981) correlated high concentrations of arsenic compounds with negative redox potentials (Eh). The injection of dissolved potassium permanganate as an aquifer rehabilitation technique resulted in in-situ As precipitation. Column studies by Ditt et al. (*Stud. Environ. Sci.*, 17, 501-506, 1981) indicated that mercury may be transported without a significant retention from a contaminated influent river to the Rhine aquifer in Alsace under oxidizing conditions. Bank filtration, used along the River Rhine, has proven to retain chemicals such as iron and phosphate (Sonthheimer, *J. Am. Water Works Assoc.*, 72, 388-390, 1980).

At the Glattfelden site in northern Switzerland, trace metal concentrations show a strong partitioning between water infiltrated from a contaminated river and aquifer sediments and even stronger partitioning in sump sludges of sampling wells near the river bank (Hoehn and von Cinnert, *Water Sci. Technol.*, in press). The sorptive behavior of organic microcontaminants (e.g., alkylated and halogenated benzenes) has been studied at this site by Schwarzenbach et al. (*Environ. Sci. Technol.*, 17, 472-479, 1983); the retention factors of these compounds depend on the respective octanol/water partition coefficients and the organic carbon content of the fine-grained sediment fraction (Schwarzenbach and Westall, *Environ. Sci. Technol.*, 15, 1360-1367, 1981). Similar results have been obtained from the study of artificial aquifer recharge (Schoeller, *DWWK Bull. Bonn ZRG*, 13, 79-94, 1982; Zulleit, *Stud. Environ. Sci.*, 17, 601-606, 1981). The theory of multiphase flow in granular aquifers has been applied to spills of oil and gasoline (Eggen and et al., *Ground Water*, 17, 586-594, 1979) and halogenated hydrocarbons (Schwille, *Stud. Environ. Sci.*, 17, 451-464, 1981).

Simulation Studies

Groundwater quality management models have been applied in the German Democratic Republic (Luckner and Nitsche, *Stud. Environ. Sci.*, 17, 953-971, 1981; Diersch, *Angew. Math. Phys.*, 63, 479-488, 1982) to problems of regional groundwater contamination related to the use of nitrates (Zwirnmann, *Stud. Environ. Sci.*, 7, 1115-1120, 1981) and to the open cast mining for lignite (Kalen, *Rep. 83-92*, Int. Inst. for Appl. Systems Analysis, Laxenburg, Austria, 44 pp., 1983). Solute transport models are linked with multiobjective methods and techniques of game analysis and have been developed to some extent at the International Institute for Applied Systems Analysis, Laxenburg, Austria. The influence of the chemical speciation of radionuclides on their transport through heterogeneous media has been considered in simulation models by Hadermann (e.g., *Nucl. Technol.*, 56, 102-105, 1982).

European hydrogeologists, as well as those from other continents, met in Copenhagen on Sept. 12-14, 1984, for a specialized seminar entitled "Degradation, Retention, and Dispersion of Pollutants in Groundwater." Subjects discussed included degradation and retention of organic substances, retention of trace metals and inorganic nutrients, and dispersion processes. The proceedings will be published by the International Association on Water Pollution Research and Control, and the meeting will be reviewed in a future edition of *WaterWatch*.

This information report was contributed by Edward Hoehn, Swiss Federal Institute for Reactor Research, Wuerthliingen.

International Water Center

The urban district of Nancy and the Town of Nancy, France, have taken the initiative of creating an International Center of Water (Centre International de l'Eau à Nancy—NANC.I.E.) in association with two universities, six engineering colleges, the Research Centers of Nancy, the Rhine-Meuse Basin Agency, and the Chamber of Commerce and Industry. The aim of this center is to promote research and technology transfer in the areas of water and sanitation. In 1983 it will initiate a research program drawing on the experience of 350 researchers and engineers of various disciplines who have already been assigned to research in these fields. The re-

search themes, the majority of which will be multidisciplinary, concern aspects of hygiene and health, the engineering of industrial processes, water resources, and the environment and agriculture. A specialist training program offering five types of training aimed at university graduates, graduates of engineering colleges, or experts, will start in October 1984.

This international center will also constitute a technical support point for the United Cities Water Agency (Agence de l'Eau des Cites Unies), which has just been created in Nancy. This agency is a branch of the World Federation of Twinned Cities, designed to form an information link between the member cities.

International Commission on Groundwater

As the U.S. Correspondent to the International Commission on Groundwater, Helen J. Peters is beginning to receive information for AGU members in the United States who are interested in international groundwater matters. Since she does not have a mailing list of AGU members who are interested, she has been unable to pass on the information. If you are interested, please send your name, address, and phone number to her at the California Department of Water Resources, PO Box 388, Sacramento, CA 95802.

Selected Papers in Hydrologic Sciences

A collection of short topical papers providing significant results of hydrologic studies by the U.S. Geological Survey, Department of the Interior, has been published as "Selected Papers in the Hydrologic Sciences, Volume 1" (*Water-Supply Paper 2262*). Edited by Eric L. Meyer, "Selected Papers in the Hydrologic Sciences" is a new journal-type publication that will be a part of the existing U.S. Geological Survey Water-Supply Paper series. The "journal" is aimed at meeting the widespread public and professional interest of the hydrologic community in timely results from hydrologic studies derived from federal research programs, federal-state cooperative programs, and some work done on behalf of other federal agencies.

This last volume, comprising eight papers, addresses a broad array of topics covering

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Water Watch (cont. from p. 1179)
 Department of Civil Engineering, University of Michigan, Ann Arbor, MI 48109. Further information can be obtained by calling (313) 219-239-6247 or 313-268-7701, or Abiola at 313-785-9664.

History of Hydrology

The AGU History and Heritage of Hydrology Committee is sponsoring its first symposium, "History of Hydrology: Earth Science Aspects," at the 1984 Fall Meeting in San Francisco. Ten papers, spanning a range of interests, will be presented. The committee plans a second symposium, also following a general topics format, for the 1985 Spring Meeting (May 27-31, 1985) in Baltimore, Md. Abstracts for this session should be submitted to the session organizer by mid-February 1985. Persons interested in presenting a paper at this session are encouraged to contact the organizer, Simon Inc., Department of Hydrology and Water Resources, University of Arizona, Tucson, AZ 85721 (telephone: 602-621-5424).

Regional Water Balance Models

A special session entitled "Analysis of Errors in Regional Water Balance Models" is planned for the AGU Spring Meeting. This symposium is sponsored by the Surface Runoff Committee and will be held in Baltimore, Md., during the week of May 27-31, 1985.

Water balance models have been utilized for decades by agricultural scientists, climatologists, hydrologists, etc. for a wide range of purposes at various spatial and temporal scales. This symposium addresses regional water balance models applied over regions in excess of, say, 50 km² and the much-neglected subject of analysis of errors in these models. Papers are solicited on this topic and may include but are not limited to studies of physical significance of state variables, parameter identification, effects of alternative networks of climatological variables, effects of different temporal resolution of precipitation data, errors associated with different methods of estimating actual evapotranspiration over large regions, accounting for seasonality, effects of spatial variations of parameters, and importance of and mechanisms for dealing with frozen ground and snow melt.

Papers may address traditional applications in hydrology, such as streamflow record reconstruction or groundwater recharge estimation, as well as other applications, such as development of drought indices or National Water Assessment-type activities. All applications, however, should be addressed with an emphasis on error propagation in the water balance models.

Anyone interested in contributing a paper should submit an abstract in AGU format by February 1, 1985, to William M. Alley, U.S. Geological Survey, 410 National Center, Reston, VA 22092 (telephone: 703-860-6927).

Karst Water Resources is Subject of Symposium in Turkey

An International Symposium on Karst Water Resources is scheduled for July 7-19, 1985, in Ankara and Antalya, Turkey. The symposium will be sponsored by the Karst Water Resources Research Center Project of Hacettepe University, the United Nations Technical Cooperation Department, and the Turkish State Hydraulic Works (DSI). Co-sponsors will be the Turkish National Committee for the International Hydrological Program, the International Association of Hydrogeologists, the International Association of Hydrogeologists, and other international technical societies and United Nations organizations. Activities will take place in Ankara, Antalya, and locations in between. The first week of the symposium will be occupied with technical papers presented orally or by poster format. Papers may be presented in Turkish or English, with simultaneous translation. Field trips of points of interest around Antalya and between there and Ankara are planned for the second week of the symposium.

The technical program is expected to provide broad coverage of topics related to water resources in karst areas. Subjects that may be considered for the symposium include hydrogeology, geochemistry, modeling, laboratory testing, tracer techniques, geophysics and other exploration methods, land subsidence and sinkhole formation, remote sensing techniques, groundwater, and surface water hydrodynamics and interpretation, engineering properties and problems, water supply estimation, and irrigation potential and irrigation practice, among other potential subjects.

Notice of intent to offer a paper and/or to attend the symposium should be sent to A. Ivan Johnson, Water Resources Consultant, Woodward-Clyde Consultants, 7600 East Orchard Rd., Harlequin Plaza North, Englewood, CO 80111 or to Gulekin Gunay, Hydrogeological Engineering Department, Hacettepe University, Turkey. Details concerning the symposium arrangements and instructions on preparation of abstracts will be sent to those who indicate interest in the symposium.

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Multivariate Analysis of Hydrologic Processes

A meeting on Multivariate Analysis of Hydrologic Processes will be held at Colorado State University, Fort Collins, Colo., on July 15-17, 1985. Sponsors will be the American Society of Civil Engineers, Colorado Section; the Hydrology Section of AGU; the International Association for Hydraulic Research (IAHR) Section on Methods for Water Resources Management; the IAHR Section on Stochastic Methods in Hydrology; the International Association of Hydrological Sciences; and the International Water Resources Association.

Conference proceedings will be published. Topics in papers include deterministic methods, statistical methods, and joint deterministic and statistical methods.

Abstracts for the meeting are due by February 10, 1984, and a full-length paper must be received by June 1, 1985. Inquiries should be directed to Hydrology and Water Resources Program, Engineering Research Center, Colorado State University, Fort Collins, CO 80523.

Hydrologic Applications of Space Technology

The International Association of Hydrological Sciences (IAHS) and the World Meteorological Organization (WMO) are co-sponsoring an International Workshop on Hydrologic Applications of Space Technology. Input to Hydrologic Models and Geographic Information Systems, to be held in Cocoa Beach, Florida, August 18-24, 1985. The workshop program will emphasize offered and invited oral or poster papers related to the input of remote sensing and remote data transmission to hydrologic models and geographic information systems.

Organizations interested in exhibiting equipment, systems, or publications or in demonstrating equipment or software programs should contact A. Ivan Johnson, President, IAHS International Committee on Remote Sensing and Data Transmission, 7471 Upham Court, Arvada, CO 80003. Persons wishing to offer an oral or poster paper for consideration by the program committee should submit a typed, single-spaced original and one copy of a 400-600 word abstract, in English, to Johnson at the above address or in the Secretary General, World Meteorological Organization, Case Postale no. 5, CH-1211 Geneva 20, Switzerland. Abstracts should be received by November 30, 1984.

Groundwater Contamination Studies

The American Society for Testing and Materials (ASTM) seeks papers for the Symposium on Field Methods for Groundwater Contamination Studies and Their Standardization, sponsored by ASTM Committee D-19 on Water and D-18 on Soil and Rock. The symposium will be held the week of February 2, 1986, in Cocoa Beach, Florida. The major topics areas include geophysical methods applied to groundwater studies, including borehole geophysics and in situ parameters and surface geophysical methods; sampling methods; field chemical analysis methods and precision; and well construction methods, including well construction and monitoring wells and casing materials.

The purpose of the symposium will be to develop information that can be used to prepare guidelines for groundwater contamination studies and to develop information for methods that can become ASTM standard methods or ASTM standard practices. Presentations for the symposium will be selected by a program committee on the basis of submitted abstracts. Offered and invited papers will be scheduled for oral or poster presentation. All papers will be reviewed and considered for publication in an ASTM Special Technical Publication (STP). ASTM may print and distribute accepted abstracts at the symposium with the approval of the chairman.

Prospective authors are requested to submit a title, a 300-500-word abstract, and an ASTM paper submittal form by March 1, 1985 to Symposium Chairman Gene Collins, National Institute for Petroleum and Energy Research, P.O. Box 2128, Bartlesville, OK 74006 (telephone: 918-336-2400). Paper submittal forms are available from Kathy Greene, ASTM Publications Division, 1916 Race St., Philadelphia, PA 19103 (telephone: 215-299-5414). Additional information on the symposium and instructions for submittal of abstracts are available from both Collins and Greene or from Symposium Vice Chairman A. Ivan Johnson, 7474 Upham Court, Arvada, CO 80003 (telephone: 303-425-5610).

Meeting Report

Reduced Liquid Movement Subject of Denver Symposium

Reduction of subsurface movement of liquids was the subject of a 1-day symposium sponsored by Committee D-18 on Soil and Rock of the American Society for Testing and Materials (ASTM) and cosponsored by the U.S. Committee on Large Dams (USCOLD) of the International Commission on Large Dams. The Symposium on Impermeable Barriers for Soil and Rock, the first specialized symposium of its kind, was held in Denver, Colorado, on June 26, 1984. The program emphasized the interaction of the environmental system of soil and rock containment, impermeable barriers, and enclosed liquids. The theory, testing, and design considerations of such interactive systems was explored in relation to slurry walls and clay and earth additive linings as applied to geotechnical engineering projects such as tailings and waste containment ponds, landfills, solar and biomass ponds, ditches, canals, and reservoirs. A number of papers presented research results on the interaction of various chemical and hazardous wastes with the soil and rock materials and lining or slurry materials.

The morning session of the symposium had eight papers addressing slurry walls, while the afternoon session had 10 papers concentrating on clay and soil additive linings. Eight papers were presented as posters during the coffee breaks and lunch period. Symposium papers will be published as an ASTM Special Technical Publication, available later in 1984.

For further information on family and active research projects, contact: Kevin Crowley, School of Geology and Geophysics, University of Oklahoma, 880 Van Vleet Oval, Norman, OK 73019.

General co-chairmen for the symposium were Lucio Ubertini, Institute Ricerche Idrologiche, Perugia, Italy, and A. Ivan Johnson, Consulting Engineer, Arvada, Colorado. Johnson was also Program Chairman, and chairperson for local arrangements was Laura Carabogian, CNR, Venice.

Persons wishing more details about the symposium should contact A. Ivan Johnson, Consulting Engineer, 7474 Upham Court, Arvada, CO 80003 (telephone: 303-425-5610). Papers will be available in a proceedings volume in early fall. The cost of the approximate 700-page volume (IAHS Publication 151) is \$35. The publication may be ordered from T. C. Riggs, IAHS Treasurer, 2000 Florida Avenue, N.W., Washington, DC 20008. Copies of the field trip guide books may be requested from Laura Carabogian, ISD/CNR 1964 Sp. Polo, 80125 Venice, Italy.

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PDSTIONS AVAILABLE

Faculty Position in Applied Geophysics or Structural Geology. The Department of Earth Sciences, University of New Orleans, invites applications for a permanent faculty position commencing August, 1985 in APPLIED GEOPHYSICS or STRUCTURAL GEOLOGY. The University of New Orleans, located on the south shore of Lake Pontchartrain has 14,000 undergraduate and 2,500 graduate students. The Earth Sciences Department currently has a staff of 11 full-time and four part-time faculty and approximately 150 undergraduate geology majors and 50 master's students.

The appointee will be expected to teach graduate and undergraduate courses in geophysics-structural geology and general geology; conduct a program of research and supervise thesis. The position will be at the assistant professor level. Applications are encouraged from individuals with industrial experience. The Ph.D. degree is required. For the two-volume conference proceedings, contact Industrial Fabric Association International, 345 Cedar Building, Suite 450, St. Paul, MN 55101.

Dr. Louis S. Faurand, Chairman
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Land Subsidence

International Symposium Held in Venice

The Third International Symposium on Land Subsidence was held March 18-25, 1984, in Venice, Italy. Sponsors were the Ground-Water Commission of the International Association of Hydrological Sciences (IAHS), the United Nations Educational, Scientific, and Cultural Organization (UNESCO), the Italian National Research Council (CNR), the Italian Regions of Veneto and Emilia-Romagna, the Italian Municipalities of Venice, Ravenna, and Modena, the Venice Province, and the European Research Office. Cosponsors included the International Association of Hydrogeologists (IAH), the International Society for Soil Mechanics and Foundation Engineering (ISSMFE), and the Association of Geoscientists for International Development (AGID).

Organized within the framework of UNESCO's International Hydrological Program, the symposium brought together over 200 international interdisciplinary specialists in the problems of land subsidence due to fluid and mineral withdrawal. Because man's continuing heavy development of groundwater, gas, oil, and minerals is changing the natural regime and thus causing water and more subsiding areas in the world, there had been sufficient new land subsidence occurrence, problems, research, and remedial measures since the 1978 Second International Symposium held in Anaheim, California, to develop a most interesting program of nearly 100 papers from about 30 countries. The program consisted of papers covering case histories of fluid and mineral withdrawal, engineering theory and analysis, karst "sink-hole"-type subsidence, subsidence due to dewatering of organic deposits or due to application of water (hydrocompaction), instrumentation, legal, socioeconomic, and environmental effects of land subsidence, and remedial works.

Venice was an appropriate location for the symposium because of the serious subsidence problems there. An interesting 1-day boat trip to local subsidence sites in the Lagoon of Venice was held during the week, in addition to a 2-day field trip on March 24 and 25 in the areas around Venice, the Po River Delta, Ravenna, and Modena.

General co-chairmen for the symposium were Lucio Ubertini, Institute Ricerche Idrologiche, Perugia, Italy, and A. Ivan Johnson, Consulting Engineer, Arvada, Colorado. Johnson was also Program Chairman, and chairperson for local arrangements was Laura Carabogian, CNR, Venice.

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Land Subsidence

International Symposium Held in Venice

The Third International Symposium on Land Subsidence was held March 18-25, 1984, in Venice, Italy. Sponsors were the Ground-Water Commission of the International Association of Hydrological Sciences (IAHS), the United Nations Educational, Scientific, and Cultural Organization (UNESCO), the Italian National Research Council (CNR), the Italian Regions of Veneto and Emilia-Romagna, the Italian Municipalities of Venice, Ravenna, and Modena, the Venice Province, and the European Research Office. Cosponsors included the International Association of Hydrogeologists (IAH), the International Society for Soil Mechanics and Foundation Engineering (ISSMFE), and the Association of Geoscientists for International Development (AGID).

Organized within the framework of UNESCO's International Hydrological Program, the symposium brought together over 200 international interdisciplinary specialists in the problems of land subsidence due to fluid and mineral withdrawal. Because man's continuing heavy development of groundwater, gas, oil, and minerals is changing the natural regime and thus causing water and more subsiding areas in the world, there had been sufficient new land subsidence occurrence, problems, research, and remedial measures since the 1978 Second International Symposium held in Anaheim, California, to develop a most interesting program of nearly 100 papers from about 30 countries. The program consisted of papers covering case histories of fluid and mineral withdrawal, engineering theory and analysis, karst "sink-hole"-type subsidence, subsidence due to dewatering of organic deposits or due to application of water (hydrocompaction), instrumentation, legal, socioeconomic, and environmental effects of land subsidence, and remedial works.

Venice was an appropriate location for the symposium because of the serious subsidence problems there. An interesting 1-day boat trip to local subsidence sites in the Lagoon of Venice was held during the week, in addition to a 2-day field trip on March 24 and 25 in the areas around Venice, the Po River Delta, Ravenna, and Modena.

General co-chairmen for the symposium were Lucio Ubertini, Institute Ricerche Idrologiche, Perugia, Italy, and A. Ivan Johnson, Consulting Engineer, Arvada, Colorado. Johnson was also Program Chairman, and chairperson for local arrangements was Laura Carabogian, CNR, Venice.

Persons wishing more details about the symposium should contact A. Ivan Johnson, Consulting Engineer, 7474 Upham Court, Arvada, CO 80003 (telephone: 303-425-5610). Papers will be available in a proceedings volume in early fall. The cost of the approximate 700-page volume (IAHS Publication 151) is \$35. The publication may be ordered from T. C. Riggs, IAHS Treasurer, 2000 Florida Avenue, N.W., Washington, DC 20008. Copies of the field trip guide books may be requested from Laura Carabogian, ISD/CNR 1964 Sp. Polo, 80125 Venice, Italy.

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High Altitude Observatory Scientific Visitor Program/NCAR. Scientific visitor appointments at the High Altitude Observatory are available for new and returning scientists in solar physics, solar-terrestrial physics, and related subjects. Applicants should submit a curriculum vitae, including education, work experience, and a statement of their research interests. Applications should be received by 15 January 1985 and they should be sent to: The HAO Visitor Committee, High Altitude Observatory, P.O. Box 3000, Boulder, Colorado 80507-3000. NCAR is an Equal Opportunity/Affirmative Action Employer.

Chairperson/The University of Tulsa, Department of Geosciences. The University of Tulsa, Department of Geosciences, invites applications for the position of Chairperson. Candidates should have a Ph.D. and a distinguished record of research and teaching. Leadership and administrative skills and experience to interact effectively with faculty, students, and the community are required. The department of geosciences has a strong research program and is located in a new teaching and research building. There is a strong emphasis on the department which has grown rapidly in the last few years. Equipment includes a VAX-11/750 computer with an array processor and seismic data processing software, SEM, Microprobe, XRF, XRD, gas chromatographs and a mass spectrometer, and other resources which are supported by "Petroleum Associates" are excellent.

Nominations and applications should be sent to: The University of Tulsa, Department of Geosciences, P.O. Box 3000, Tulsa, Oklahoma 74104. The University of Tulsa is an equal opportunity/affirmative action employer.

The Department of Geology and Geophysics at the University of Minnesota/Stratigraphy in Large Scale Geology. The Department of Geology and Geophysics at the University of Minnesota is seeking a Ph.D. in geology to fill a new position in the Department of Geology and Geophysics. The position will be available in the Department of Geology and Geophysics, University of Minnesota, Minneapolis, Minnesota 55455. The University of Minnesota is an equal opportunity/affirmative action employer.

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Scripta Institution of Drenography, Geological Research Division: Stable Isotopes/Sedimentology. The Scripta Institution of Drenography, Geological Research Division: Stable Isotopes/Sedimentology, is seeking an Assistant Research Scientist. We are looking for candidates with a strong background in sedimentology and an interest in paleoclimatology, paleogeography, or carbonate geochemistry and sedimentology. References will be given to persons experienced in the operation and maintenance of mass spectrometers. Level of appointment and salary will be commensurate with experience, according to the Scripta Institution of Drenography standards. Applications should be addressed to Dr. W.H. Berger or M. Kasper, Scripta Institution of Drenography, La Jolla, CA 92038, A-015.

Marine Geophysicist/Texas A&M University. The Department of Oceanography invites applications for a tenure track position in its geological/geophysical section in the general field of marine geophysics and geophysical oceanography. A Ph.D. is required. Rank and salary of the position are open. The successful applicant will be expected to initiate a vigorous research program. There is an interest in seafloor geophysics and geophysical oceanography. The Department of Oceanography, Geophysics, and the Geodynamics Research Program. Duties will also include the teaching of M.S. and Ph.D. students. The position is available beginning September 1, 1985. Applications should be sent to: Dr. T.K. Treadwell, Faculty Search Committee Chairman, Department of Oceanography, Texas A&M University, College Station, Texas 77843. Closing date for applications is January 31, 1985. Texas A&M University is an equal opportunity/affirmative action employer.

Postdoctoral Positions/Applied Chemistry. Applications are invited for two postdoctoral positions in the areas of applied chemical kinetics, atmospheric chemistry, and microbial kinetics of iron(II) reduction. Experience in one or more of the following areas is desired: ligand-substitution kinetics, solution phase kinetics, ester hydrolysis, photo-assisted catalysis, field-oriented cloud, fog, or rainwater chemistry, homogeneous and heterogeneous catalysis by transition metal complexes, microkinetic substitution reactions, rapid reaction kinetics, or applied microbiology. Send resume and three letters of reference to: Prof. Michael R. Hoffmann, Engineering and Applied Science, W.M. Keck Laboratories, California Institute of Technology, Pasadena, CA 91125.

Physical Oceanography, Postdoctoral Fellow. One to three year appointment, for persons interested in large scale circulation and geophysical oceanography. Ph.D. in physical oceanography required. Position available approximately January 1985. Remuneration with names of three references should be sent to: Dr. B. C. Ingram, Oceanography Department, 3020 University St., Montreal, Quebec, H3A 2B4 Canada. All applicants are encouraged to apply but preference will be given to Canadian citizens and permanent residents.

Astronomy/Magnetospheric/Planetary/Digital Imaging Science. This is an opportunity to become involved in state-of-the-art data management techniques, and admission with distinguished research interests. The National Space Center is an equal opportunity/affirmative action employer. The position will be available in the Department of Geology and Geophysics, University of Minnesota, Minneapolis, Minnesota 55455. The University of Minnesota is an equal opportunity/affirmative action employer.

National Space Science Data Center. The National Space Science Data Center is seeking a Ph.D. in geology to fill a new position in the Department of Geology and Geophysics. The position will be available in the Department of Geology and Geophysics, University of Minnesota, Minneapolis, Minnesota 55455. The University of Minnesota is an equal opportunity/affirmative action employer.

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Northern Arizona University/Department Chairperson. The Department of Geology, Northern Arizona University, is seeking a chairperson for the Department of Geology, beginning summer 1985. Specialized experience in geophysics and geophysics problems. Applicants must be capable of interacting professionally and have an active and diverse faculty of 14 geologists. Candidates should have a Ph.D. and a distinguished record of research and teaching. The Department has been granted funding authority for a Ph.D. program 30 it is essential the successful candidate possess the desire to guide the Department through the final planning stages. The Department has a strong tradition in field problems in

